

The qualifier is intended to initiate an exchange of ideas between the student and the examiners. The examiners are not simply looking for answers to questions, but are instead exploring how the student responds to intellectual challenges. They need to see the process by which the student formulates a problem and works his or her way through it. By probing the limits of knowledge we see how the student will approach things not yet understood, the essence of research.

Of great importance is the ability to think logically, in contrast to simply collecting facts and data. Related to this is the ability to apply the scientific method to explain complex phenomena, build complex systems, and explain complex ideas using simple, well-understood constructs.

The student must demonstrate a minimum level of understanding of their field, but this is not sufficient to establish an ability to conduct research. There must also be an ability to discern connections between fundamental ideas, and to apply those connections in approaching an unfamiliar problem. For example, questions about extending ideas from the presentation are important in determining whether the student can move beyond what has already been learned, especially when the answers can only be found through application of problem solving skills.

The examiners do not necessarily expect the student to know the answer to a particular question, in fact, they might not know the answer themselves, but are curious to learn how the student applies basic knowledge, mathematical skills, and scientific reasoning to elucidate the problem.

When confronted with an unfamiliar situation, we expect students to:

- understand the question; if not, then to ask clarifying questions
- clearly state the assumptions necessary to tackle the problem
- if necessary, make quantitative estimates of unknown parameters needed to solve the problem
- formulate a plan of attack, typically a series of steps involving application of fundamental principles
- understand the limits of their approach
- be able to explain their approach to the examiners
- do all the above in a quantitative fashion

Please note that this list does not say "give the correct quantitative answer to the question".